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## IMEF Commanding General Visits Warfighter Performance Lab at NHRC

*Story courtesy of Naval Health Research Center Public Affairs*



Capt. Kim Lefebvre (second from left) Naval Health Research Center (NHRC) executive officer, and Cmdr. Shawn Soutiere, left, department head for NHRC's Warfighter Performance Laboratories, provided Lt. Gen. David Berger, I MEF commanding general, a tour of the lab and an overview of research capabilities for improving the physical and cognitive readiness of warfighters. NHRC conducts research, development, testing, and evaluation to optimize military operational health and readiness. (U.S. Navy Photo by Regena Kowitz/Released)

SAN DIEGO – Staff from Naval Health Research Center's (NHRC) Warfighter Performance Department welcomed Lt. Gen. David Berger, I Marine Expeditionary Force commanding general, on an official visit to the command, March 16.

The purpose of the visit was to highlight NHRCs research capabilities for optimizing the physical health and medical readiness of service members and conducting operational equipment testing and evaluation.

During the visit, NHRC researchers provided Berger with an interactive

tour of the Warfighter Performance Lab that included overviews of current research into human performance optimization, the effects of new protective gear and equipment on warfighter performance, injury prevention and rehabilitation, fatigue and sleep performance, and environmental physiology.

"Our team at NHRC is comprised of experts in biomedical engineering, research psychology, physiology, physical therapy, and kinesiology," said Capt. Kim Lefebvre, NHRC's executive officer. "Their skill and dedication to

*(continued on page 3)*

## NMRC Commanding Officer's Message



April is one of my favorite months! Besides warmer weather and spring flowers we get to celebrate both the *Month of the Military Child* and *Take Your Daughter and Son to Work Day*. These two events allow us to reflect on the unique challenges faced by military kids and gives us the opportunity to assess how we are developing the future medical and scientific workforce. Each year we become increasingly accustomed to technology and globalization. Future leaders of healthcare and medical research are developing ideas about future careers, whether they know it or not.

They are Generation Z 'ers (GZ) - those teens and early twenty-year-olds growing up in a new century. This generation will bring a unique technological acumen toward solving problems as they become scientists. They are the first truly digital generation - raised in a high-tech, hyper-connected, on-demand culture. They have friends across the globe, some they've never met and only know through social media. It is vital that we encourage these young people to consider Science, Technology, Engineering and Mathematics (STEM) careers so they can develop knowledge and skills to solve tough biomedical research problems that will be faced by military forces.

GZers bring new approaches to solving problems, but also expectations with respect to care and delivery. These expectations will require us to reexamine the flexibility of programs to develop and maintain workforces, and deliver excellence in healthcare services. NMRC has several avenues to engage younger generations towards careers in science and is involved in educational outreach to encourage GZers to consider research as a career. Last month, NMRC volunteers participated in the STEM event hosted by the DoD National Museum of Health and Medicine's Annual Brain Awareness Week for local middle-school students. This month, NMRC volunteers will participate in "Take Our Children to Work Day" April 28. Others will participate in the Science in Society Conference hosted by the Centennial High School in Ellicott City, Maryland. Soon we will begin seeing summer interns from the Office of Naval Research (ONR), Naval Research Enterprise Internship Program (NREIP) and Science and Engineering Apprenticeship Program (SEAP). These high school, undergraduate, and graduate students participate in current research studies under the guidance of experienced mentors.

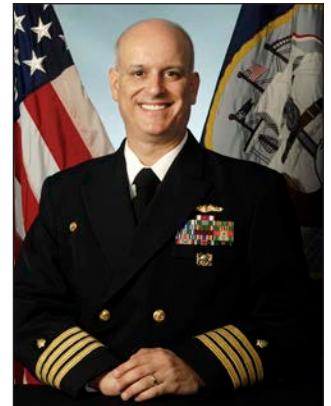
I believe we are making a huge difference in growing the future DoD workforce that will incorporate technological advances to satisfy our desire to solve the toughest medical problems. I commend all of you for your ongoing work in developing this future workforce!

NMRC Commanding Officer sends,  
Jacqueline D. Rychnovsky, CAPT, NC, USN

## NSMRL Commanding Officer's Message

Reflecting back on my time as commanding officer of NSMRL, it has truly been a fantastic year! We have hosted visits from the Navy Surgeon General, the Brazilian CNO, the Undersea Warfare Division, the Submarine Force Commander, Navy Medicine West and Congressmen and Senators. They are impressed by what we do for the submarine force and the Navy. These visits have me thinking about why we exist; to deliver healthcare solutions to the Navy submarine force. Submarines operate in littoral (coastal) waters, in contested waters and remotely under the polar ice caps performing a variety of operational tasks surpassing those of competing military navies. This country's submarine force is the dominant undersea force in the world! Perhaps the biggest challenge is maintaining the health and welfare of submariners. If a single submariner becomes ill, injured or otherwise incapacitated, the mission of the submarine is jeopardized ... and by extension, national strategic interests are jeopardized.

To that end, delivering timely evidenced-based healthcare solutions is NSMRL's primary mission. As we have said goodbye to Vice Adm. Michael Connor and welcome the new Commander of Submarine Forces, Vice Adm. Joseph Tofalo, we remain committed to our singularly-focused mission of providing healthcare solutions to the most medically challenging platform in the Navy. Delivering healthcare to deployed submariners is no easy task. NSMRL is involved in multiple initiatives with submariners including development and simulation of Virginia-class submarine escape and rescue procedures, atmospheric monitoring and analysis, the e-cigarette debate, resiliency and fatigue of submarine teams, women in submarines initiatives, waiver and medevac analysis, the "UnPlanned Loss" issue, submarine medical qualifications standards, psychologic screening of prospective submariners, microbiome of submariners and development of the Ohio replacement class medical spaces. Recently, a contingent from NSMRL attended the NATO Submarine Escape and Rescue Working in Marmaris, Turkey. NSMRL participated in the international medical standardization panels and the next Escape Exercise planning meeting. NSMRL took the lead on centralization of international submarine escape training data. This was the first time NSMRL participated in this international meeting since 2010. Following this meeting, NSMRL participated in the U.S.-U.K. submarine medicine meeting in Gosport, U.K. This was a very productive meeting and the first since 2009.



In conclusion, it has been a spectacular high-energy year for NSMRL. We look forward to continued focus on submarine force medical priorities and strengthened international collaborations. We are humbled and honored for the opportunity to serve the men and women of submarine force!

NSMRL Commanding Officer sends,  
Frederick Yeo, CAPT, MC, USN

(continued from page 1)

our mission of improving readiness through research that has practical application is a key factor in our ability to successfully meet the needs of the fleet and warfighters in support of their missions."

The tour included a demonstration of the Computer Assisted Rehabilitation Environment (CAREN), a cutting-edge research tool that incorporates motion capture cameras, a large curved projection screen, surround sound, and a motion platform that creates an immersive virtual environment. Initially used for the recovery and rehabilitation of wounded warriors, the CAREN has been modified by NHRC scientists and transformed into a more powerful tool that is used to:

- ~ Define the physical and cognitive capabilities and limits of healthy warfighters

- ~ Evaluate new technologies for enhancing performance and reducing injuries

- ~ Support sleep optimization and fatigue mitigation studies

- ~ Assess prototypes of new gear being proposed for troop use and its impact on performance.

Berger was also given an overview of the Sleep Lab, including current research into sleep optimization throughout the continuum of military service, and the Environmental Chamber, which can simulate environments with temperatures ranging from -23°F to 130°F to assess the impact of extreme cold and heat on health, performance, and gear.

"Several of NHRC's studies involve Marines and focus on improving their physical and cognitive readiness through research, development, testing, and evaluation," said Lefebvre.

"Lt. Gen. Berger's visit provided an opportunity for him to meet the experts who are spearheading this research and discuss how science can optimize performance in challenging environments and positively impact the health of Marines now and over the course of their careers."

As the DoD's premier deployment health research center, NHRC's cutting-edge research and development is used to optimize the operational health and readiness of the nation's armed forces.

In proximity to more than 95,000 active duty service members, world-class universities, and industry partners, NHRC sets the standard in joint ventures, innovation, and translational research.

## NAMRU-6 and PROMELA Conduct Workshop

*Story by Dr. Silvia Montano and Lt. Nathaniel Reynolds, NAMRU-6*

LIMA, Peru - U.S. Naval Medical Research Unit No. 6 (NAMRU-6), in collaboration with The Latin American Armed Forces Laboratories Improvement Program (PROMELA) conducted a workshop entitled "External Quality Control for HIV Rapid Testing based on the Dried Tube Specimen (DTS) Technique" March 21 -23.

PROMELA, funded by the DoD HIV prevention Program (DHAPP), aims to strengthen the quality management systems of clinical laboratories of the Armed Forces hospitals or health facilities by enhancing quality assurance and biosafety capacities of laboratory personnel. Enhanced quality assurance is pursued by PROMELA using the External Quality Assessment, which involves training in proper handling and implementation of proficiency testing



*Opening Ceremony with Peruvian Military laboratory participants PROMELA training on HIV Rapid Testing on Dried Tube Specimens 21-23 March, 2016 in Lima, Peru. Capt. Adam W. Armstrong, MC USN, Commanding Officer U.S. NAMRU-6 (Front Row Center) opened the training. GEN Victor Valladares Esquivel, Deputy Director, Peruvian Army Health Command (Front Row, second from left), Dra. Vilma Béjar Castillo, Tropical Medicine Institute, UNMSM also attended the opening ceremony (Front Row, third from right). (Photo courtesy of NAMRU-6 Public Affairs)*

(continued on page 14)

# NMR&D Enterprise JOOY Award

*Story by Capt. Patrick J. Blair, NAMRU-3*

CAIRO - During his visit to the U.S. Naval Medical Research Unit No. 3 (NAMRU-3) in Cairo, Rear Adm. Bruce Gillingham, Commander Navy Medicine West, presented Lt. Johnny R. Oliva with the 2015 Naval Medical Research Center Enterprise Junior Officer of the Year (JOOY) Award, March 20.

Naval Medical Research Center Commanding Officer, Capt. Jacqueline Rychnovsky, informed Oliva he had won the award Feb. 8. The JOOY competition is open to officers from 0-1 to 0-4 serving at NMRC or one of its seven commands.

Nominees have demonstrated and maintained a high standard of personal and professional performance in the preceding year and significantly elevated the mission of the enterprise. They are rated by a board comprised of the enterprise executive officers on their primary job responsibilities, performance, leadership and contributions to their respective commands and communities.

Oliva served as a Navy Hospital Corpsman prior to commissioning as a hospital administrator in the Medical Service Corps (MSC) in 2008. From 2009 to 2010, he was the Tactical Operations Officer (TOC) for the NATO Multi-National Medical Unit Role 3 in Kandahar, Afghanistan. After a tour as Department Head for Operations Management at the Naval Medical Center San Diego, he received orders to the Navy Medicine Training Support Center at Joint Base San Antonio.

In 2014, Oliva was hand-selected by the MSC detailer to fill the Director for Administration (DFA) position at NAMRU-3, a billet gapped for 18



Rear Adm. Bruce Gillingham, Commander Navy Medicine West, presented Lt. Johnny R. Oliva with the 2015 Naval Medical Research Center Enterprise Junior Officer of the Year (JOOY) Award, March 20. (Photo courtesy of NAMRU-3 Public Affairs)

months. He arrived in Cairo June 2014 and - amidst daunting personnel shortcomings - quickly set about to rebuild the Administrative Directorate, reestablishing and organizing functions within the Human Resources, Information and Materials Management Departments.

Oliva led command preparation for reaward of contracting authority through a series of training, capacitation evolutions and material management audits and reinvigorated Navy programmatic, resulting in an overall score of "compliant" on the recent MEDIG inspection.

"Lt. Oliva's resilience and initiative have been hallmark towards his success," said NAMRU-3 Commanding Officer, Capt. John Gilstad. "Through his perseverance,

he has won the confidence of his shipmates and superiors."

Oliva represents NAMRU-3 on the Awards, Housing, Management and Special Immigrant VISA committees at the U.S. Embassy. Still he has found time to advance U.S. and Department of Defense cultural and professional values, proctoring English Language exams for Egyptian military officers and interloping with ex-patriots from Paraguay, Spain and Mexico during U.S. Embassy community events while serving as a volunteer referee at neighborhood youth soccer matches.

Reflecting on his tour, Oliva opined that "the OCONUS laboratories allow us to serve both within our professional disciplines as well as U.S. diplomats. This experience is enriching like no other."

# NHRC Partners with DTRA to Protect Warfighters from Emerging Infectious Diseases

Story courtesy of NHRC Public Affairs



Staff from Naval Health Research Center's (NHRC) Operational Infectious Diseases directorate and the Defense Threat Reduction Agency (DTRA). NHRC and DTRA personnel came together in San Diego for a two-day meeting to discuss current progress and future goals for the Field Forward Diagnostics program, a collaborative biosurveillance project. The purpose of the program is to evaluate handheld diagnostics devices and test a system for broadcasting data from the devices to remotely located subject matter experts. Using the devices, forward deployed troops could detect pathogens that would then be transmitted to and analyzed and identified by the subject matter experts who would provide immediate guidance to the troops and their leaders. (Photo courtesy of Naval Medical Research Center Public Affairs)

SAN DIEGO – Scientists from the Naval Health Research Center (NHRC) and the Defense Threat Reduction Agency (DTRA) held a two-day meeting to discuss progress and goals for a joint biosurveillance project, March 7-8.

NHRC has collaborated with DTRA and the Joint Science and Technology Office on the Field Forward Diagnostics program since 2013 to develop novel point of need diagnostics to identify pathogens that cause acute febrile illnesses and threaten global and public health.

"The goal of the program is to enhance readiness by enabling our warfighters to use handheld diagnostic devices in the field to detect pathogens that can cause incapacitating or deadly diseases," said NHRC Commanding Officer, Capt. Rita Simmons. "Once a pathogen has been

identified, immediate guidance could be provided to troops and their leaders to help them deal appropriately with the health threat. This project has the potential to significantly impact medical and mission readiness."

The joint NHRC and DTRA team will evaluate the handheld devices for ease of use and test a system for broadcasting data from the devices to remotely located subject matter experts for real-time decision making on events occurring in far-forward areas. The project would bring the expertise of medical and public health professionals to troops in the field.

According to Dr. Christopher Myers, department head for biosurveillance at NHRC, emerging infectious diseases that our military could encounter around the globe, particularly those found in tropical

settings such as dengue, Burkholderia melioidosis, and malaria, are often difficult to distinguish by their clinical characteristics alone.

"Confirmation from a laboratory is needed for a definitive diagnosis, but if you're in the field, forward deployed, a lab can be hard to come by," said Myers.

As part of the collaborative effort, NHRC will monitor all sites involved in the study to ensure that protocols are being followed and data properly collected. NHRC will also provide logistical support by shipping supplies and instruments, and coordinating maintenance and repairs as needed, to the different study sites around the globe.

# NAMRU-SA Focuses on Monitoring Immune System to Diagnose and Treat Traumatic Injuries

Story by R. Madelaine Paredes, Ph.D., NAMRU-San Antonio

SAN ANTONIO - Traumatic injury is a leading cause of mortality in the military and civilian population. The loss of blood, combined with tissue damage, initiates a physiologic response that can promote both reparative wound healing and deleterious inflammation, depending on the predisposition of the affected individual's immune system.

In the department of Combat Casualty Care at Naval Medical Research Unit San Antonio (NAMRU-SA), we work towards understanding both the physiologic and molecular changes which occur in response to traumatic injury. Therefore, one of our primary focus areas is the identification of the mechanism(s) the immune system exploits to respond to injury, specifically hemorrhage and poly-trauma.

Like most other things, humans have widely varying immune systems due to a variety of factors including genetic makeup, gender, age, lifestyle, and previous antigen exposure. Collectively, each of these factors contributes to an individual's immune system's response to insult.

Our research at NAMRU-SA employs models that closely replicate militarily relevant injuries in order to translate our findings from the laboratory and into the clinical setting. Finding solutions to diagnose and treat injuries our warfighters sustain on the battlefield is our ultimate goal.

One of the tools we use to monitor the status of the immune system in conditions such as traumatic hemorrhage is immune-phenotyping. This involves uncovering the contributions of different immune cell populations in terms of both their occurrence over time (kinetics) and expression of inflammatory factors (functionality).

Here we use a sophisticated technique termed flow cytometry which allows us to perform exhaustive characterization of the



*Dr. R. Madelaine Paredes, researcher in NAMRU-SA's Immunodiagnostic and Bioassay Development Department demonstrates the use of the flow cytometer technique to perform single cell measurements. Flow cytometer can identify the numbers of cells that have a particular feature (size, or a specific marker in their surface or intracellular). Navy researchers can then discern what molecules are being produced by each cell type and compile an extensive inflammatory profile for that particular sample. (Photo courtesy of NAMRU-SA Public Affairs)*

immune response with cellular resolution required only a few microliters of sample.

Flow cytometry utilizes the power of fluidics to pass cells in suspension through a laser beam. Physical properties of cells and particles are then captured and converted to quantifiable outputs to measure cell size and granular content. Importantly, fluorescently labeled antibodies can be employed to tag specific proteins, such as surface receptors or intracellular molecules, permitting a nuanced and in-depth cellular analysis.

We utilize flow cytometry to determine the contributions of various white blood cells (i.e. T-cells and B-cells) to the inflammatory milieu in trauma. Moreover, we discern what molecules are being produced by each cell type and compile

an extensive inflammatory profile for that particular sample.

Through immunophenotyping, we can accomplish three critical goals: first, we will be able to uncover key cells and cell products required for orchestrating immunologic reactions to injury; second, foster a more complete understanding of the signaling pathways that become deranged in trauma patients; and lastly, determine which, if any, of these molecules can be exploited as therapeutic targets or opportunities for clinical intervention.

These studies continue to provide vital knowledge for both research efforts and clinical decision-making within the trauma and critical care fields.

# NMCSD Military and Veteran Resiliency Medicine Summit

*Story courtesy of NHRC Public Affairs*

SAN DIEGO – Two researchers from the Naval Health Research Center (NHRC) participated in the Military and Veteran Resiliency Medicine Summit at Naval Medical Center San Diego (NMCSD) Feb. 25-26.

NMCSD hosted the summit to equip health care providers who treat active duty military, veterans, and their family members with the latest research and evidence-based skills in mind-body medicine.

Marc Taylor, Ph.D., presented his poster, "Genetic variants in serotonin and corticosteroid systems modulate neuroendocrine and cardiovascular responses to intense stress," during the two-day event.

The poster addressed genetic factors that influence stress reactivity in service members undergoing survival training. Taylor's research shows how genetics can modulate a service member's response to intense stress in a military training environment.

"Our findings may have implications for gene therapy, drug development for stress disorders, as well as creating strategies for stress inoculation and management for both healthy and vulnerable military populations," said Taylor.

During the Friday session, Jason Jameson, Ph.D., and Chris Demuro, Ph.D., discussed a research framework for resilience training.

Their presentation, "Towards Best Practices in the Implementation and Evaluation of Mental Skills Training," focused on potential courses of action



*Marc Taylor, Ph.D. (left), and Jason Jameson, Ph.D. (right), from the Naval Health Research Center (NHRC), participated in the Military and Veteran Resiliency Medicine Summit at Naval Medical Center San Diego (NMCSD) Feb. 25-26. NMCSD hosted the summit to equip health care providers who treat active duty military, veterans, and their family members with the latest research and evidence-based skills in mind-body medicine. (Photo courtesy of NHRC Public Affairs)*

for developing effective and sustainable resilience training given the constraints of military environments.

"There has been a growing interest in the possibility of training resilience," said Jameson. "Critical questions are how we can make this happen and how can we implement and evaluate such training in military environments?"

Jameson's presentation described how research can answer those questions so that the value of potential courses of action can be comprehensively tested.

Traditional research methods, according to Jameson, are typically drawn from

academic environments that, while important, are limited when considering practical solutions ideal for the military environment.

"Our goal was to present a proposal on how we can overcome the challenges to identify the most promising practical solution for developing resilience training from among a set of many possibilities," said Jameson.

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*Graphic illustration by Mikelle D. Smith, Naval Medical Research Center Public Affairs*

# NAMRU-San Antonio Scientist Receives Top Paper Award

Story courtesy of NAMRU-San Antonio Public Affairs



Randy Crossland, Ph.D. (right), a key researcher in NAMRU-SA's Expeditionary and Trauma Medicine Department received a Combat Casualty Care Research Program coin from Lt. Col. (Dr.) Kevin Chung, Research Director, U.S. Army Institute of Surgical Research (ISR) at Joint Base San Antonio, Fort Sam Houston, for earning the Top Paper of the Month in February 2016. (Photo by Sgt. Nguvan Uhaa)

SAN ANTONIO - Randy Crossland, Ph.D., a key researcher in NAMRU-SA's Expeditionary and Trauma Medicine Department received a Combat Casualty Care Research Program coin from Lt. Col. Kevin Chung, Research Director, U.S. Army Institute of Surgical Research (ISR) at Joint Base San Antonio, Fort Sam Houston, for earning the Top Paper of the Month, Feb., 5.

Every month ISR celebrates the dissemination of research knowledge in the form of published manuscripts. The translation of knowledge gained through pre-clinical and clinical experiments to optimize combat casualty care is core to both the ISR and NAMRU-SA missions. NAMRU-SA also shares actual office/lab space within ISR.

NAMRU-SA submitted three papers in response to the monthly call for published manuscripts. In addition to Crossland's work on the rapid assessment of shock as the *Top Paper of the Month*, NAMRU-SA scientist in immunology, Philip J. Vernon, Ph.D.'s work on maladaptive immune response was selected as one of the top three papers of the month. Also, NAMRU-SA researcher Antonio R. Macko, Ph.D. was recognized for his translational research on hemorrhage.

This monthly celebration of science acknowledges and recognizes the collective work of investigators across the services within ISR.

## Citations:

Crossland, Randy F. PhD; Mitchell, Alex MD; Macko, Antoni R. PhD; Aden, James K. PhD; Campbell, James E. PhD; Sheppard, Forest R. MD, et al. Rapid Assessment of shock in a nonhuman primate model of uncontrolled hemorrhage: Association of traditional and nontraditional vital signs to mortality risk. *J Trauma Acute Care Surg.* 2016;80 (4):610-616.

Vernon PJ, Schaub LJ, Dallelucca JJ, Pusateri AE, Sheppard FR (2015) Rapid Detection of Neutrophil Oxidative Burst Capacity is Predictive of Whole Blood Cytokine Responses. *PLoS ONE* 10 (12): e0146105.

Macko, Antoni R. PhD; Crossland, Randy F. PhD; Cap, Andrew P. MD, PhD; Fryer, Darren M.; Mitchell, Thomas A. MD; Pusateri, Anthony E. PhD; Sheppard, Forest R. MD, et al. Control of severe intra-abdominal hemorrhage with an infusible platelet-derived hemostatic agent in a nonhuman primate (rhesus macaque) model. *J Trauma Acute Care Surg.* 2016;80 (4): 617-624.

# NAMRU-SA Dental Researchers Assess Using CAD/CAM Technology

Story by Lt. Noel E. Dickens, DMD, NAMRU-San Antonio



**SAN ANTONIO** - The Craniofacial Health and Restorative Medicine Directorate at Naval Medical Research Unit San Antonio (NAMRU-SA) is dedicated to assessing dental related factors that influence whether Sailors and Marines remain fit to fight.

Navy dentistry's primary focus is to provide quality dental care in a timely manner that maintains a high state of operational readiness for Sailors and Marines.

Currently, warfighters in need of larger dental restorations such as crowns wait weeks while tooth restoration is fabricated. This delay typically leads to reduction in operational dental readiness as active duty patients are fitted with temporary dental crowns and remain in non-deployable statuses until completion.

New computer-aided design and manufacturing (CAD/CAM) systems shorten this time by allowing rapid scanning, designing, development and production of dental restorations.

Using this technology gives dentists the ability to produce high quality esthetic treatments in single settings, making it a potential tool to achieve high operational dental readiness in a rapid manner.

Researchers at NAMRU-SA have been studying longitudinal placement rates of digitally fabricated in-office esthetic restorations compared to traditional laboratory fabricated restorations by providers in Navy Dental Treatment facilities.

Placement rate data used for comparison were generated by analyzing data recorded

*Lt. Noel Dickens, dental researcher, and Head of Epidemiology and Biostatistics Department in NAMRU-SA's Craniofacial Health and Restorative Medicine Directorate, demonstrates the new computer-aided design and manufacturing CAD/CAM restoration technology. The CAD/CAM system can rapidly produce esthetically pleasing, functional, time saving and cost-effective dental restorations to help Sailors and Marines remain fit to fight. (Photo courtesy of NAMRU-SA Public Affairs)*

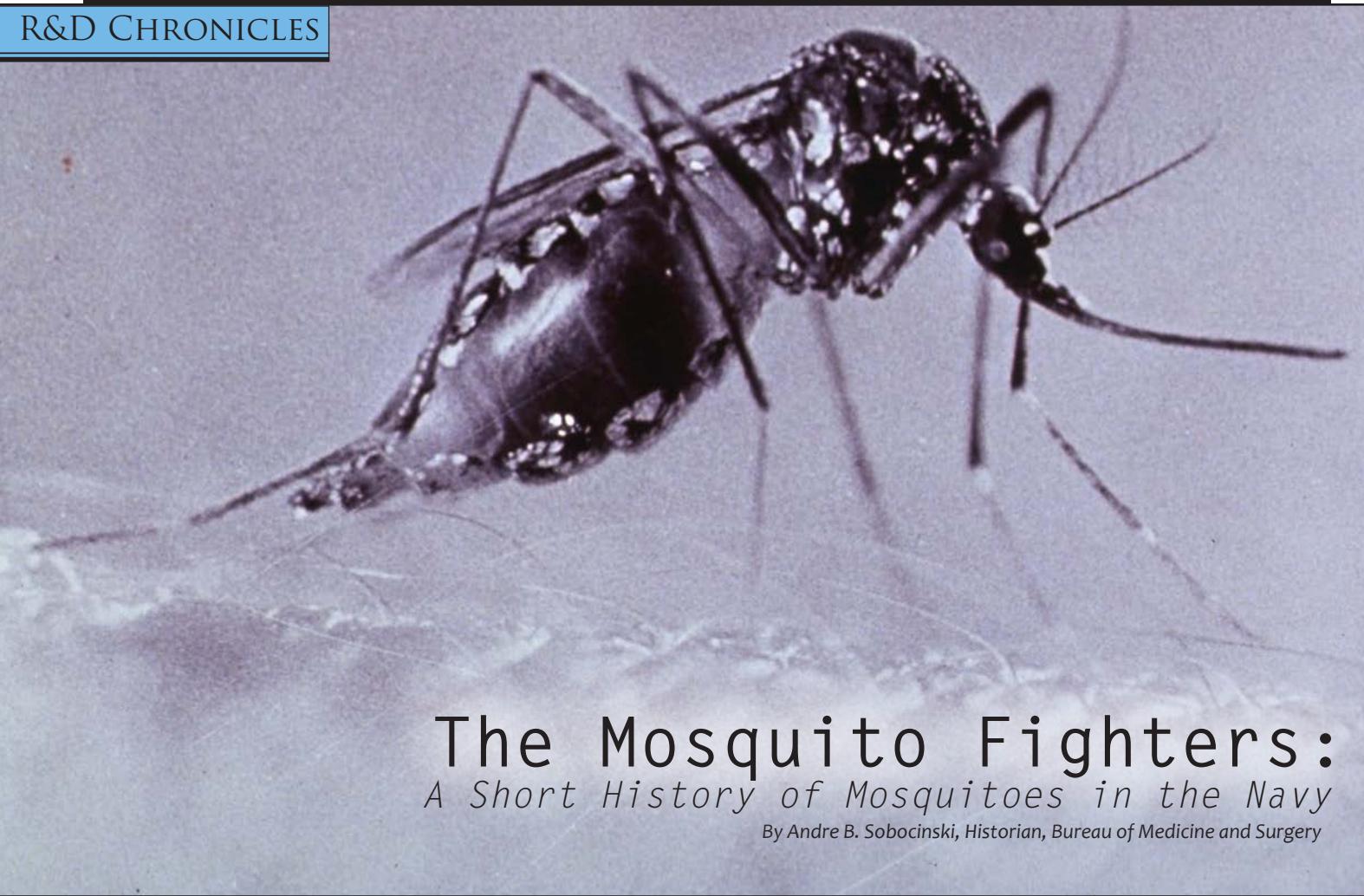
in the Navy's Dental Common Access System (DENCAS), a data repository for all dental procedures completed by Navy dentists.

Placement of CAD/CAM chairside restorations by Navy providers has increased each year since data collection of CAD/CAM restoration codes began in Oct 2011 as evident by an 84 percent increase in average monthly placement rates from 2012 (189) to 2015 (348).

The increase in CAD/CAM restorations demonstrates a growing acceptance and utilization rate by Navy dentists and also underscores CAD/CAM technology's ability to produce esthetically pleasing, functional, time saving and cost-effective dental restorations.

Digital dental technology is rapidly expanding among the dental profession and increasingly being utilized by Navy dentists both in shore-based and operational settings where dentists are assigned. The number of CAD/CAM restorations placed is expected to continue rising as more milling devices are placed in Navy dental clinics and more dentists are trained in their use.

The technology is ideal for the military health care environment where the focus is to reduce traditional delays, maintain a high state of dental readiness, and improve patient access during times of high operational tempo.



# The Mosquito Fighters: A Short History of Mosquitoes in the Navy

By Andre B. Sobociński, Historian, Bureau of Medicine and Surgery

## Part I: Introduction

Over the course of the U.S. Navy's history the mosquito has been a constant threat whose enduring swath of destruction far extends that of the Barbary Pirates, the Imperial Japanese fleet or even German U-boats.

From the Navy's first conflict - in the so-called Quasi-War with France (1797-1801) - our small fleet was deployed to the tropical climes of the West Indies where they engaged in warfare with French privateers.

Medical logs from these first Navy ships are full of cases of "Ague," "Fever and Ague," "Bilious Fever," "Inflammatory Fever," "Intermittent Fever,"

"Remittent Fever," and "Putrid, Malignant Ship Fever" - all archaic terms for mosquito-borne illnesses.

The story of the armed merchant ship USS *Delaware* offers an example of the impact mosquitoes had in the Quasi-War. On an unseasonably warm day in December 1799, the *Delaware* limped into the port of Curacao with its crew incapacitated with "fever."

Over the next month some 130 members of the ship's complement—a staggering 72 percent of the crew!—was infected with this fever. The ship's physician, Surgeon's Mate Samuel Anderson, described attending to patients

under a stale air punctured by the "offensive effluvia" of bilge water. This was an age when some diseases were still associated with atmospheric conditions, noxious vapors and "miasma" ("pollution" or "bad air.")

Anderson established a temporary hospital on shore where his patients were exposed to more "salubrious conditions" and subject to the standard practices of the day—a combination of purgatives and bloodletting.

Although, the concept of Germ Theory and the idea of mosquito-transmitted diseases were still decades away,

(continued on page 11)

*"On the 16<sup>th</sup> of December 1799 the fever commenced with uncommon violence and malignancy..."*

*~Surgeon's Mate Samuel Anderson (1773-1850)~*



(continued from page 10)

Anderson came very close to identifying the cause of the malady. He prophetically noted that among his patients: "Eruptions of various kinds appeared. That which was most common and struck my attention most, was in every respect similar to mosquito [sic] bites."

Throughout the history of the world the ancient creature called the mosquito has been the scourge of humankind, spreading more illness and causing more death with a simple bite than any other living organism past or present.

In 2014, The Gates Foundation identified the mosquito as

the "deadliest animal" in the world causing more deaths a year than sharks, snakes, and humans combined.

Of the more than 3,000 species of mosquito, three can be credited as the most proficient killers—the female of the Aedes, Anopheles, and Culex genera.

These little mosquitos are responsible for transmitting a host of viruses including Chikungunya, Dengue, Japanese Encephalitis, Malaria, West Nile, Yellow Fever, and most recently Zika.

The World Health Organization (WHO) estimates that each year hundreds of millions of people are infected with these diseases and several million die.

In the ensuing multi-part series in NMRC News, we will be focusing on the tiny death-dealer and the Navy's own plight against it—from an early medical investigation into a mosquito-borne disease (1823) to the epidemics that shaped the service to the unsung mosquito fighters who pioneered the concepts of prevention, education and research.

It is a fight that is as old as the Navy itself and one marked by many hallmarks, innovations and heroics.

# Joint En Route Care Working Group Visits NAMRU-Dayton

Story by Naval Medical Research Unit Dayton Public Affairs

DAYTON, Ohio - The Joint En Route Care (Joint ERC) working group meeting was held at Wright-Patterson Air Force Base (WPAFB), Ohio, March 14-16.

The working group supports Combat Casualty Care Joint Program Committee (JPC-6), a Congressionally Directed Medical Research Programs Defense Medical Research and Development initiative.

Naval Medical Research Unit Dayton (NAMRU-D) select staff were invited to the meeting, which was hosted by Col. Sue Dukes, Aeromedical Research Division Chief, U.S. Air Force School of Aerospace Medicine (USAFSAM), WPAFB and Dr. Richard Hersack, Aeromedical Research Department Director, Air Force Materiel Command, WPAFB. NAMRU-D's Capt. Rees Lee, Executive Officer; Dr. Richard Arnold, Aeromedical Research Director; and Lt. Cmdr. Michael Tapia, Biomedical Sciences Department Head attended.

More than 30 members of the working group visited three of NAMRU-D's Aeromedical Research Directorate laboratory spaces.

Dr. Lynn Caldwell, Senior Research Psychologist, described NAMRU-D's Fatigue Countermeasures Program to the group. Recent research in this program has focused on the effects of modafinil and over the counter stimulants on physical and cognitive performance.

Dr. Jeffrey Phillips, Cognitive Research Psychologist, informed the group on NAMRU-D's Hypoxia Mitigation Program.

Previous research has shown that hypoxia negatively affects the ability of an operator to take corrective action



*Members of the Joint En Route Care working group visit Naval Medical Research Unit Dayton's Disorientation Research Device (DRD) control room during an overarching function held at Wright-Patterson Air Force Base. (Photo courtesy of NAMRU-D Public Affairs)*

or enact emergency procedures more rapidly than outlined in Time of Useful Consciousness (TUC) tables. However, the detailed nature of the decline in performance preceding total incapacitation had not been examined until a recent investigation conducted by NAMRU-D.

The aim of the study was to complement the existing TUC table by examining the rate of cognitive decline. Results suggested that hypoxia exposure can lead to a rapid destabilization of performance earlier than those times put forward by the TUC table. (*Technical Report recently uploaded to DTIC*).

Rounding out the Joint En Route Care working group tour, Dr. Arnold provided a brief on NAMRU-D's Disorientation Research Device (DRD) during the visit.

The DRD can support several key

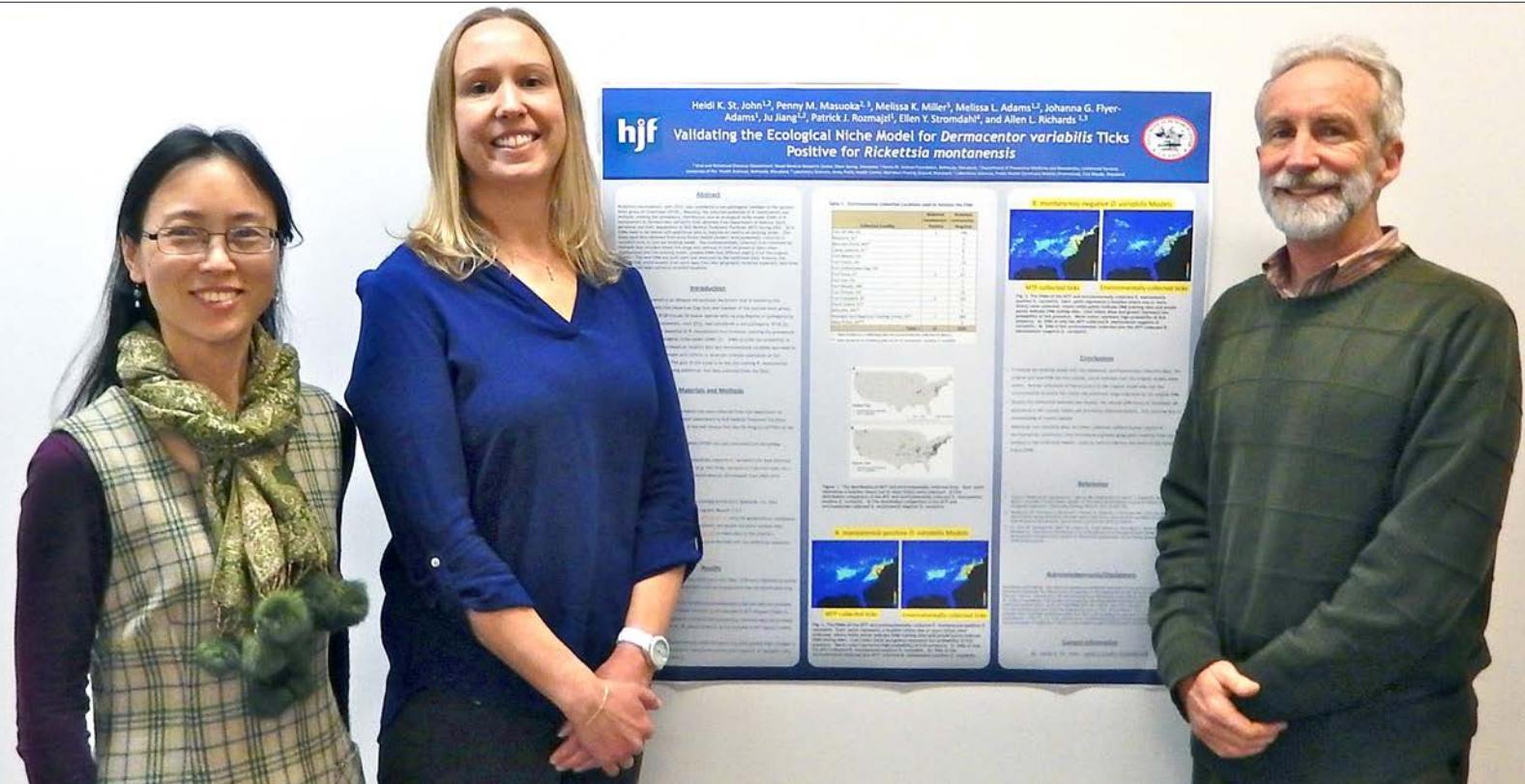
human systems integration domains and address several Commander Naval Air Forces Top Aeromedical Priorities. The DRD will be capable of providing the highest levels of flight simulation fidelity.

This capability will enable the validation of simulation-based training scenarios for combating spatial disorientation, which is the leading cause of deadly aviation mishaps in the Naval Services and Department of Defense.

The visit showcased research capabilities that could support En Route Care. The joint approach from NAMRU-D, USAFSAM, and Air Force Materials Command during this meeting emphasized the vision to solve the naval and joint warfighter challenges of the future.

# NMRC Researchers Attend Fifth Mid-Atlantic Tick Summit

Story by Heidi St. John, Naval Medical Research Center



Dr. Allen Richards (right), Ju Jiang (left), and Heidi St. John (center) attended this meeting to learn and discuss new ideas in tick and tick-borne disease research, March 2. (Photo courtesy of Heidi St. John)

SILVER SPRING, Md. - Researchers from Naval Medical Research Center (NMRC)'s Viral Rickettsial Diseases Department (VRDD) attended the fifth Mid-Atlantic Tick Summit in Laurel, Maryland, March 2.

This annual regional meeting allows for exchange of scientific knowledge and cross-disciplinary collaborations that benefit the military and public communities. In discussing regional-specific findings of ticks and tick-borne diseases, innovative ideas and research can be developed.

Dr. Allen Richards, Ju Jiang, and Heidi St. John attended this meeting to learn and discuss new ideas in tick and tick-borne disease research that could yield new applications and improve data collection and testing for disease surveillance and management.

Examples of such collaborations and findings have led to publications and presentations that have stemmed from this meeting to include the St. John, et. al. article "Prevalence, Distribution, and Development of an Ecological Niche Model of *Dermacentor variabilis* Ticks Positive for *Rickettsia montanensis*" that is ahead of print and will be in the April edition of the journal Vector Borne and Zoonotic Diseases.

The result of this work was further evaluated/validated using data obtained from last year's summit collaborations and presented in this year's meeting via a poster entitled, "Validating the Ecological Niche Model for *Dermacentor variabilis* Ticks Positive for *Rickettsia montanensis*".

This single day event allowed fellow

scientists, collaborators or future collaborators from the DoD, local health departments, universities, etc. to share ideas in a smaller forum for the betterment of science and military and/or public health.

The primary focus of the Viral Diseases Division is on the development of a vaccine to prevent dengue fever; the main objective of the Rickettsial Diseases Division is to develop a scrub typhus vaccine.

An additional focus of the department is to develop and evaluate field-deployable diagnostic assays for the rapid and accurate detection of dengue virus (antigen or viral RNA) and dengue-specific antibodies in human clinical samples using innovative immunological or molecular approaches.

# NAMRU-6 and PROMELA Conduct Workshop

(continued from page 3)

(PT). However, a number of resource and logistical conflicts with laboratories in Latin America, including limited budget, staff, and appropriate specimen transport, confound PT implementation.

To address these challenges, a new cold-chain independent approach has been utilized by the PROMELA program for testing of quality control specimens. These control specimens include serum or plasma specimens, prepared as dried tube specimens (DTS), which are stable for at least a month at room temperature and can be used to prepare panels for PT. In 2009, Bharat Parekh, MD (CDC - Centers for Disease Control and Prevention) and colleagues presented a new technique that provides a simple solution to implement Proficiency Tests programs for HIV, named Dried Tube specimen (DTS). This technique offers the advantage of being able to prepare panels for quality

control assessment easily and without the requirement of cold chain transport.

The DTS technique provides several advantages, including increased safety and less biological risks than a liquid sample. Also, the specimens are stable at environment temperatures. Dr. Silvia Montano of U.S. NAMRU-6 said "This technique provides a cheap and sustainable process for enhancing the reliability of HIV rapid testing in the region." The absence for the need for cold chain transportation allows for easy and inexpensive transport. Specimens can be stored at room temperature without adversely affecting their integrity. DTS has a great potential to facilitate the external quality assurance process and can be included in all testing sites monitored by one central laboratory.

To ensure complete understanding and application within the participant's laboratories, wet-lab benchtop practices

were conducted as part of the workshop. Benchtop practices involved hands-on training in DTS processing, testing, results interpretation and reporting procedures.

Important lessons learned from this workshop included safety and quality parameters involved with handling DTS kits and the importance of developing external quality control programs within the respective laboratories. To this end, PROMELA will work with the individual laboratories to implement a pilot program and Committee for HIV Prevention for the Peruvian Armed Forces (COPRECOS-Peru) involving external quality control that leverages laboratory technical assistance through NAMRU-6. Capt. Adam Armstrong, Commanding Officer of NAMRU-6 reinforced the importance of this interaction and stated that the training provided a natural extension and progression of the PROMELA program that has developed through DHAP?

## PHOTOS



Members of the Military Women's Health Research Interest Group (MWHRIG) met March 14-16 at the Naval Health Research Center (NHRC) for a quarterly meeting to advance research that targets military women's health care. The MWHRIG researchers, who are sponsored by the TriService Nursing Research Program, are collaborating on developing a research agenda that addresses knowledge gaps and increases visibility of women's health issues through research. The group has a three-pronged mission: review scientific literature from 2000 to 2015 to identify gaps in current knowledge; review health care utilization data for male and female service members; and identify how health care utilization patterns align with the literature. Bottom row, left to right, Dr. Lori Trego, Ms. Megan Foradori, Lt. Col. Leilani Siaki (U.S. Army), and Ms. Roby Martin. Top row, left to right, Lt. Col. Candy Wilson (U.S. Air Force), Dr. Nancy Steele, Maj. Kim Hopkins (U.S. Air Force), and Cmdr. Abigail Yablonsky. (U.S. Navy photo by Regena Kowitz/Released)

# NMRC Researchers Participate in NMHM Brain Awareness Event

Story by Mikelle D. Smith, Naval Medical Research Center Public Affairs

SILVER SPRING, Md. – Researchers from the Naval Medical Research Center (NMRC) participated in the DoD National Museum of Health and Medicine's (NMHM) 17<sup>th</sup> Annual Brain Awareness Week event, March 17.

Brain Awareness Week is one of the museum's central efforts to support DoD STEM (science, technology, engineering and math) workforce development priorities. The program is closely aligned with performance expectations for middle-school students as described in the Next Generation Science Standards set by the National Academy of Science.

Deputy Director of NMRC's Operational and Undersea Medicine Directorate (OUMD), Lt. Cmdr. Peter Walker and researcher, Lt. Melissa Mehalick, participated in the event highlighting some of OUMD's work related to blast injuries and monitoring brain activity. NMRC was one of several DoD activities participating in the event.

Walker and Mehalick also took turns helping students try on flak jackets, a form of body armor designed to provide protection from case fragments from high explosive weaponry; Kevlar helmets with blast sensors, and even demonstrated the feeling of a blast using balloons.

"As both Naval officers and neuroscientists, it is very rewarding for us to contribute to the development of students' interest in STEM fields in order to help develop the next generation of scientists," said Walker. "Many students enjoyed the simulated experience of theatre by wearing military combat helmets and vests



Deputy Director of Naval Medical Research Center's (NMRC) Operational and Undersea Medicine Directorate (OUMD) Lt. Cmdr. Peter Walker (center) monitors students as they try on a flak jacket during a demonstration at the National Museum of Health and Medicine's Brain Injury Week event. (Photo by Mikelle D. Smith, Naval Medical Research Center Public Affairs)

equipped with pressure sensors."

The event included several hands-on station activities to learn about brain functions, brain disorders and influences on the brain. Middle school students from numerous local schools in Maryland and Washington D.C. rotated through interactive learning stations. More than 120 students participated in the event.

"Brain Awareness Week exists to inspire an interest in brain sciences in the minds of our young visitors, so that we may someday see them develop into a new generation of neuroscientists," said Andre Schierkolk, NMHM public program manager. "Partnering with some of the most cutting-edge brain science research organizations in the country, Brain Awareness Week at NMHM highlights research and advances from those individual agencies and

promotes this field as a career options."

NMHM is home to one of the world's most comprehensive neuroanatomical collections and features a major exhibit on traumatic brain injuries. The exhibit showcased actual human brain specimens that demonstrate a variety of brain injuries including hemorrhage, blunt force trauma and bullet wounds.

The mission of OUMD is to conduct medical research, development, testing and evaluation to develop new information and technologies to enhance the health, safety, performance, and deployment readiness of Navy and Marine Corps personnel. The OUMD Directorate consists of three departments: NeuroTrauma, Undersea Medicine, and Regenerative Medicine.